Biological formation of mesoporous amorphous and crystalline Materials

*A keynote talk*

Yue, Yuanzheng; Keding, Ralf; Jensen, Martin; He, Wen; Cui, Jingjie; Zhang, Xudong

*Publication date:*
2010

*Document Version*
Accepted author manuscript, peer reviewed version

*Link to publication from Aalborg University*

*Citation for published version (APA):*
BIOLOGICAL FORMATION OF MESOPOROUS AMORPHOUS AND CRYSTALLINE MATERIALS

Y. Z. Yue\textsuperscript{1,2}, M. Jensen\textsuperscript{1}, R. Keding\textsuperscript{1}, W. He\textsuperscript{2}, J. J. Cui\textsuperscript{3} and X. D. Zhang\textsuperscript{2}

\textsuperscript{1}Section of Chemistry, Aalborg University, Denmark
\textsuperscript{2}Key Laboratory of glass & ceramics, Shandong Institute of Light Industry, Jinan, China
\textsuperscript{3}Department of Chemistry, Shandong University, Jinan, China

Abstract

Mesoporous materials can be synthesized through different approaches. In this paper, we report a biological approach, by which high purity mesoporous amorphous silica is synthesized. This approach is discovered by studying the macro- and microstructures and the formation mechanism of the freshwater sponge \textit{Cauxi} that were collected at the river bank of the Rio Negro in the Amazon basin. The study revealed that the skeleton of sponges is constructed by amorphous silica spicules (average diameter: 15.6 µm) that are cemented by proteins at the junctions. Such amorphous spicules contain randomly oriented mesopores. The characterization of the freshwater sponge \textit{Cauxi} shows that the mesoporous amorphous silica silica can be synthesized in aqueous solution under ambient conditions via biological catalysis. Here we describe the macro- and microstructural features, the mechanism of biological precipitation, and the glass transition of the \textit{Cauxi} skeleton.

In addition, we established a bio-mimetic approach for synthesizing high-performance mesoporous crystalline TiO\textsubscript{2}. The key step of this approach is to apply Baker’s yeast cells as biotemplates for deriving the hierarchically ordered mesoporous anatase structure. The yeast-TiO\textsubscript{2} exhibits remarkable electrocatalytic activities and outstanding photocatalytic performances. The approach may open new vistas for fabricating advanced mesoporous crystalline materials under ambient conditions.

References:
Please select the field in which the abstract is to be accommodated:

- Solvothermal/hydrothermal processes
- Soft solution processes
- Thermodynamics
- Supercritical fluids
- New solvents as ionic solvents

**X Novel synthesis**
- Functional materials
- Electronics & IT
- Nanomaterials-nanostructures

**X Porous materials and catalysts**
- Inner space science & Technology (Geochemistry)
- Life Sciences
- Biomedical & Biomimetic materials
- Hydrometallurgy
- Green sustainable technology
- Environmental science
- Other related emerging topics

Presenting author: Yuanzheng YUE

Title: **x** Prof. □ Dr. □ Mr. □ Ms.

Category: **x** Invited □ Regular □ Student

Please select your preference: □ Oral □ Poster

E-mail: yy@bio.aau.dk